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Hospital Building Sustainability: the Experience in using Qualitative Tools and Steps Towards the Life Cycle Approach

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Abstract

With the rising worldwide sustainability trends, the healthcare industry is encouraged for philosophical, societal and economic reasons to implement the "greening movement" in its practice. Consequently, this move has resulted in the development of several sustainability certification tools focusing on healthcare settings. Among the best known ones are BREEAM, LEED and Green Guide for Healthcare. Their ease of use, holistic approach and possibility of implementation from the early-design phase, have made them very attractive among different building practitioners. Yet, their subjectivity in the assessment approach, leaves a doubt whether the use of these schemes leads to truly sustainable buildings. This has led to an increased awareness among building practitioners that the qualitative tools to assess the sustainability of their projects are not sufficient. The same questions on the sustainability of hospitals arose in the Flemish healthcare sector as well. On-going development of the Duurzaamheidsmeter zorg, a qualitative tool adapted for the Flemish context, aims at helping building practitioners in assessing the sustainability of their hospital projects. However, urban planners and architects who had the opportunity of using it, reported some disadvantages and shortcomings. A need is identified to develop a more reliable sustainability assessment method based on a quantitative approach. This paper elaborates the first step in the research, analyzing the building professionals' experiences in using sustainability assessment tools on hospital facilities in Flanders. Their feedback is translated into a SWOT analysis which identifies the professionals' expectations of an assessment method. The results are seen as valuable directions to consider when developing an evaluation method from a life cycle thinking perspective.

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Keywords: hospitals; sustainability; SWOT analysis, assessment methods

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1. Introduction

Demographic changes, followed by the alterations in disease patterns and technological advancement (1), have led to an increased interest in the way hospitals are designed today. Questions on their adaptability to meet the future, unpredictable patient needs and medical-technical equipment improvements are usually brought to the fore. However, with the aim to decrease the negative impacts of the construction sector to the environment, it is equally expected of hospitals to introduce the sustainability concept in their design and operation. Nevertheless, although these buildings represent one of the largest sectors of economy in the West, hospitals have been very slow in addressing the sustainability issue (2). Surprisingly, only few studies have been carried out concerning the sustainable development of healthcare units, mostly focusing on business or waste management and energy efficiency (3). To the present, a holistic assessment of the environmental impact of hospital building has not yet been developed.

To facilitate the sustainability evaluation of healthcare facilities from the early design phase, several certification tools have been developed. To name but a few, there are BREEAM, LEED and Green Guide for Healthcare. Although these tools gained popularity among different building practitioners due to their ease of use, their subjectivity in the assessment approach causes doubts whether the use of these schemes leads to truly sustainable buildings (4). Therefore a quantitative approach, using the life cycle thinking perspective seems to be the most appropriate in this case.

The paper focuses on two existing certification schemes used in Flanders, namely BREEAM New construction and Duurzaamheidsmeter Zorg. The aim is to compare both schemes in terms of their weighting criteria and coverage of the building life cycle phases in order to pinpoint the differences between the two tools. Furthermore, both schemes are evaluated through a SWOT analysis based on the architects experiences in using them.

2. Literature review

2.1. Changes in the Flemish healthcare landscape

Hospital buildings in Flanders, as many others all over the world, are facing the challenge of mitigating their environmental impact, while remaining focused on offering affordable and quality medical care available to everyone. During the past fifteen years, the number of general, specialized and psychiatry hospitals in the Flemish region has decreased, while the number of beds remained the same (Fig. 1.) (5).

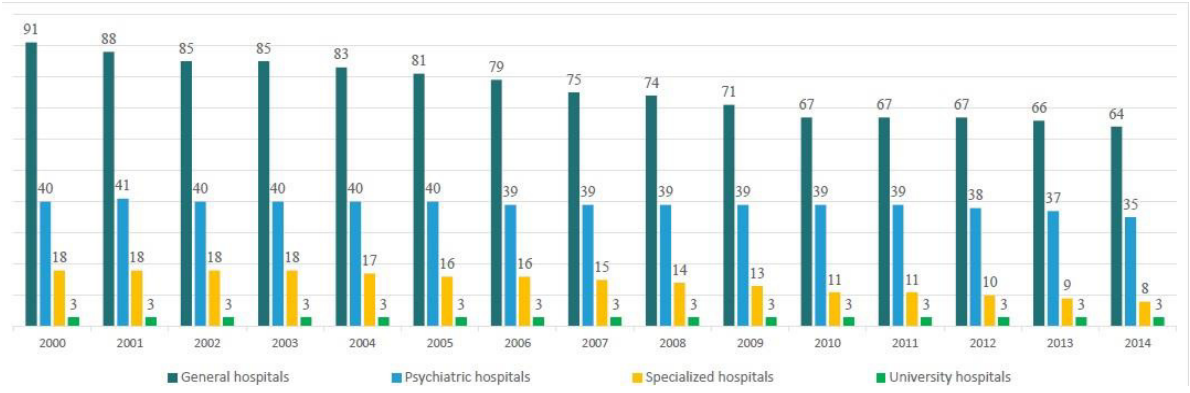

Fig. 1. The evolution of the hospital number in Flanders.

This change in the Flemish healthcare landscape is reflected in the merging of several hospitals into one, larger hospital building. The new facility is usually relocated to an empty greenfield in a peripheral area of a city, or it is clustered on an existing healthcare campus next to the old hospital, with the assumption that the latter will be

demolished in the future. Either way, this relocation increases transport distances and hence leads to higher CO_2 emissions. It moreover requires large infrastructure works and induces a major impact on the surrounding environment.

2.2. Sustainability assessment tools in the context of the Flemish region

To gain better insight in the sustainability of hospitals and to respond to the ongoing trends in building certification, the BREEAM New construction scheme was introduced in Belgium. Additionally, as there is no specific BREEAM New construction manual for healthcare, building practitioners in Flanders rely on the BREEAM Bespoke process. In this scheme, the Building Research Establishment (BRE) sets the criteria specific for the building and its units (6). As hospitals are quite complex buildings, consisting of several dozens of different departments, it is necessary to appoint the corresponding criteria where needed.

To overcome this lack of a specific certification scheme adjusted for the healthcare facilities in the Belgian context, the Flemish Infrastructure Fund for Person-related Matters (VIPA) commissioned the development of the tool Duurzaamheidsmeter zorg (Sustainability meter) in the recent years. Stevanovic et al (6) identified in their study the similarities of this tool with BREEAM and showed that it is mostly based on the New construction scheme with an addition of the criteria concerning social and cultural aspects. By introducing the aforementioned criteria, VIPA tried covering two sustainability pillars, i.e. environmental and social, in contrast to BREEAM which is mainly covering ecological aspects. Another attempt of VIPA was to shift towards a more holistic approach by implementing the criteria concerning the economic pillar. Thus, the Management criteria of the Duurzaamheidsmeter zorg was enriched with the Corporate Social Responsibility (CSR) aiming at promoting a more active attitude within institutions towards sustainability (8). Architects involved in the development of the Duurzaamheidsmeter zorg reported that it is not sufficiently detailed, nor innovative in its evaluative approach. This is seen as the possible contribution to the designer's impression of not achieving the desired level of sustainability (data retrieved from the interviews with the architects).

The structure of the Duurzaamheidsmeter zorg is the same as of the BREEAM New construction, i.e. it consists of three important parts: criteria, assessment indicators and credits (7). Some minor differences in weight allocation (presented in percentages) is identified (Fig. 2).

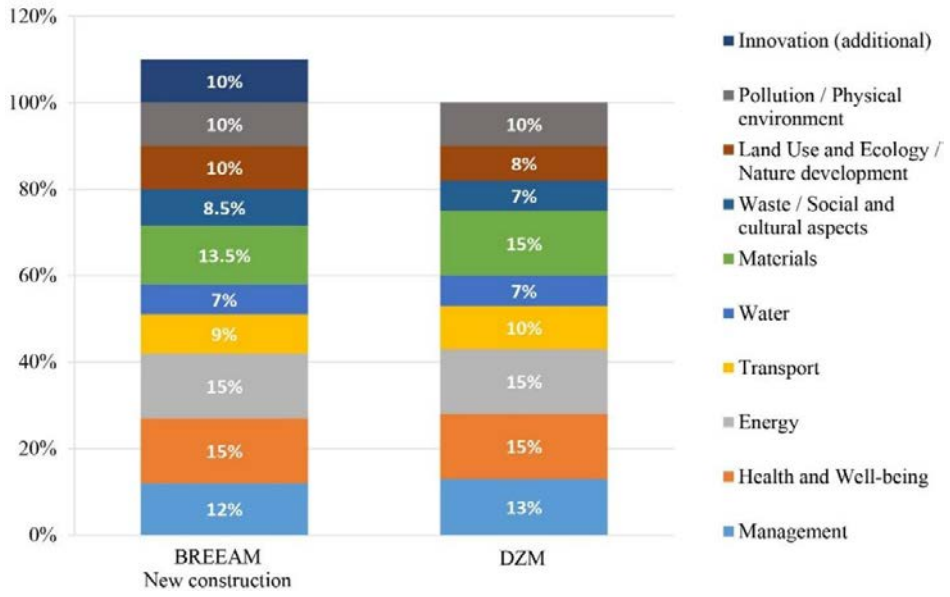

Fig. 2. Difference in weight allocation of BREEAM New construction and Duurzaamheidsmeter zorg (DZM).

Another difference worth mentioning is the coverage of the building's life cycle phases. As shown in study by Haapio and Viitaniemi (9), BREEAM considers the majority of the life cycle phases, while the Duurzaamheidsmeter zorg, on the other hand, covers only design, materials and components production, construction and use/operation phase (Table 1).

Table 1. Building life cycle phases covered by BREEAM and Duurzaamheidsmeter zorg

	BREEAM	**DZM**
Project/design	x	x
Production of materials and components	x	x
Construction	x	x
Use/operation of the building	x	x
Maintenance	x	/
Demolition	/	/
Disposal	x	/

2.3. Objectives of the study

Wrong decisions or 'underestimations' made at the early design phase are often difficult and expensive to remediate. For large-scale projects, such as many hospital buildings in Flanders built during the most recent decade, the life cycle environmental impact and cost can be huge if not well-designed. For this reason, a life cycle assessment (LCA) and life cycle costing (LCC) approach is preferred in order to realistically quantify the environmental impact and cost of hospitals from a life cycle thinking perspective in the early design phase.

The purpose of the first step in the study is to explore the architects experience in using qualitative tools to assess the sustainability of hospital buildings. Their feedback is important in order to understand expectations and needs from the tools in the early design phase. Furthermore, the aim is to summarize the reported advantages and disadvantages which will be essential in developing the assessment method form the life cycle thinking perspective.

The intention of the study is not to provide the general data about the two tools, but rather to explore the expectations that building practitioners have from the building sustainability assessment tools.

3. Methods

3.1. Participants

Two architects from the VK STUDIO Architects, Planners & Designers company were interviewed. The selection of the participants was done based on their experience in hospital sustainability assessment and because both of them are BREEAM assessors. Another crucial criteria for the choice of the aforementioned architects was their collaboration with VIPA in developing the Duurzaamheidsmeter zorg.

3.2. Structured interviews

To gather the relevant data for the study, three structured interviews were organized. The first two interviews were done through a written form, i.e. e-mail conversations which allowed the participants to answer the questions in a more detailed way. The first two interviews were focused on the Flemish certification scheme. Architects were asked to explain the purpose of creating the Duurzaamheidsmeter zorg, the stages of the development, who were the stakeholders involved in the development, and how the weighting allocation was proposed.

The last interview was organized in a form of a meeting where both architects were asked the same open questions prepared in advance. Each participant was given sufficient time to provide an answer from his own experience and perspective. As both participants were aware of the researcher's study, it was agreed that the meeting will be recorded in order to prevent any data loss, as well as to revise the answers several times to extract all relevant information.

3.3. Data analysis

After reading several time the transcripts from the first two interviews, the collected data were analyzed in terms of the three topics: (1) coverage of the sustainability pillars, (2) advantages and disadvantages of the tool compared to BREEAM and (3) level of user-friendliness. The extracted results were used to formulate the question for the last interview. The recordings of the last interview were converted into the transcripts which facilitated the process of dividing the data related to each tool. The separated data were then classified according to the four topics: strengths, weaknesses, opportunities and threats of the two tools. To do this, the sorting was done by open coding, using the qualitative data analysis software (Saturate).

4. Results

4.1. SWOT analysis

The codes from the classified data are translated into the SWOT (strengths, weaknesses, opportunities and threats) table to pinpoint the advantages and disadvantages of the two certification schemes (Table 2) from the architects' point of view.

Table 2. SWOT analysis - comparison of the strengths, weaknesses, threats and opportunities of BREEAM New construction and Duurzaamheidsmeter zorg

	BREEAM New construction	**Duurzaamheidsmeter Zorg**
Strengths	• Updates and improvements • Clear point allocation • User-friendly	• Developed for the healthcare sector specifically • Adjusted to the Belgian context • Clear point allocation • Integration of some criteria covering the economic and social pillars of sustainability
Weaknesses	• Only ecological • Immense administrative work • Lack of the full life cycle assessment • No clear definition of the sustainable built environment • No holistic approach to sustainability • Certification is based rather on theoretical modelling than on the performance • Low credits for materials • Complex (Bespoke) for healthcare	• Covers only three phases of building life cycle: design, construction and use phase • No full life cycle assessment • Low credits for materials • No holistic approach to sustainability • Certification is based rather on theoretical modelling than on the performance
Opportunities	• Global demand on certification • Global awareness about sustainability issues • Guidelines in pre-design phase of a project • Potential stakeholders involvement will grow	
Threats	• Subjective scoring allocation; building practitioners not driven by sustainability, but rather by achieving higher number of points • Possibility of becoming more complex • The number of mandatory courses increases – too expensive • Time consuming process – requires a lot of literature study	• No platform for questions and answers • Final version of the tool might not be released • Conflict with the introduction of the new medical technologies and the reduction of consumption and m^2

and administrative work

In general, from this analysis, we identified that in the architects' opinion, both tools have a very low weighting allocation for materials. Feedback of architects moreover highlights that the current sustainability assessment schemes require a time consuming process as it involves an intensive literature study and a lot of administrative work.

4.2. BREEAM New construction

As it is discussed previously, due to the lack of the specific BREEAM New construction scheme for healthcare facilities, BREEAM Bespoke is used to assess the sustainability of hospital buildings. The process is very time consuming, it involves a lot of literature study and the administrative work is quite complex (based on the feedback from architects). Another drawback of this scheme is the low weight allocation for the building materials. It is possible to achieve maximum (85%) in all other criteria except in materials and still get an outstanding performance level, which the interviewed architects reported as strange. An interesting statement, derived from the interviews, is that there is no clear definition of the sustainable built environment. Building practitioners are often driven by achieving higher scores in their evaluation rather than by the improvement of the sustainability level. One of the possible threats of the BREEAM Bespoke for hospitals is that it might become more complex in future, which would consequently demand even more costly trainings of assessors. From the architects' point of view this might lead to the loss of interest to do sustainability assessment in the future.

Positive aspects of this tool stressed by the architects are: regular updates and improvements, promotion of the global awareness on the sustainability issues and the use of the tool in the early design phase as guidelines towards sustainable building.

4.3. Duurzaamheidsmeter zorg

Major improvement of the Duurzaamheidsmeter zorg as opposed to the BREEAM New construction, is that this tool is specially designed for the sustainability of the healthcare buildings in Belgium. The implementation of some of the economic criteria as well as the emphasis on the social ones are clearly seen as strengths of this tool.

However, the primary disadvantage of this tool is that it is not yet developed completely and thus, only a pilot version can be used by the current developers. Speaking of the spotted threats, VIPA has not foreseen the platform for questions and answers in case the building practitioners have doubts while performing a sustainability assessment. Another one is that the predictions on technological innovations of certain medical equipment are not taken into account. These improvements might cause a higher energy consumption and an increase in square meters of certain departments in future, whereas the aim is to mitigate this consumption.

5. Conclusions and discussions

Clearly, architects are in need of appropriate methods that help them evaluate the sustainability of hospital projects from the early design phase. As hospitals are complex systems, housing several different building types such as residential, office and service buildings 'under the same roof', assessing their sustainability is a real challenge. The first step in approaching the sustainability from the life cycle thinking perspective is to examine the current healthcare landscape in the Flemish region as well as which hospital model is expected in the future. Next, it is necessary to conduct a rough LCA and LCC analysis on one or several hospitals in the Flemish region which will allow to identify hotspots and methodological challenges for a quantitative life cycle approach. This analysis is necessary in view of developing a comprehensive qualitative method that will facilitate building practitioners' decision making from the early design phase onwards.

This paper resulted in several outputs. First, it shows major differences between the BREEAM New construction and Duurzaamheidsmeter zorg schemes in terms of the weight allocation and the coverage of the building's life cycle phases. Second, it allows gaining better insight into architects' experience in using the aforementioned schemes and their expectations of future hospital sustainability assessment methods. Finally, the professionals' feedback provides valuable directions to consider when moving towards a qualitative sustainability evaluation of the healthcare building stock.

The main limitation of the present study is that only two architects have been interviewed, therefore, no generalization of the findings is possible. Further research is necessary to increase the accuracy of the results.

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